

## Anomalous Origin of Cystic Artery and its Surgical Implications

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**Abstract:** Cystic artery is usually a branch of right hepatic artery given in the Calot's triangle. Variations in the origin of cystic artery have been reported but there is paucity of literature regarding these in Indian subjects. The development of biliary vasculature is quite complex and it accounts for many variations. The present case describes the origin of cystic artery from the superior mesenteric artery, with an unusual course, which was detected during routine cadaveric dissection in an approximately 60 years old male cadaver. The embryological development and clinical implications of such a variant have been discussed in this article. Knowledge of cystic artery variability facilitates intraoperative identification of vessels in both classical and laparoscopic surgery of the bile ducts. This emphasises the importance of a thorough knowledge of the cystic arterial variations that often occur and may be encountered during both laparoscopic and open cholecystectomy. Uncontrolled bleeding from the cystic artery and its branches is a serious problem that may increase the risk of intraoperative lesions to vital vascular and biliary structures during hepato-biliary surgery.

**Keywords:** Cystic artery, Hepatic artery, Calot's triangle, Superior mesenteric artery, Biliary vasculature, Cholecystectomy.

### INTRODUCTION

The cystic artery after arising from the right hepatic artery at the cysto-hepatic angle immediately to the right of common hepatic duct passes anterior to the cystic duct. From there it reaches the superior aspect of the neck of gallbladder where it divides into superficial and deep branches. The superficial branch ramifies on the gallbladder to divide into superficial and deep branches. The superficial branch ramifies on the inferior aspect of gallbladder and the deep branch on the superior aspect; these branches anastomose over the surface of body and fundus. Anatomical variations of the cystic artery are commonly encountered during cholecystectomy. In most of the cases, the cystic artery arises from the right hepatic artery. The other origins

include the left hepatic artery, the proper hepatic artery, the common hepatic artery, the gastro-duodenal artery, the superior pancreatico-duodenal artery and the superior mesenteric artery. In previous literature, the cystic artery found to be arising from the gastroduodenal artery passes anterior to the structures in the free margin of lesser omentum and travels a long distance before supplying the gall bladder [1, 2]. In addition to the variability in origin of the cystic artery, its course can also follow diverse paths, often in close proximity to the common bile duct. On laparoscopic visualisation, anatomical relations are seen differently than during conventional surgery, so proper knowledge of the hepato-biliary structures under the conditions of laparoscopic visualisation is also required.

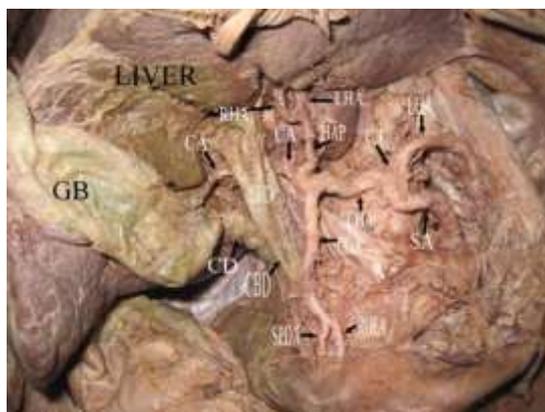


Fig-1: Normal anatomy of origin and course of cystic artery

## CASE REPORT

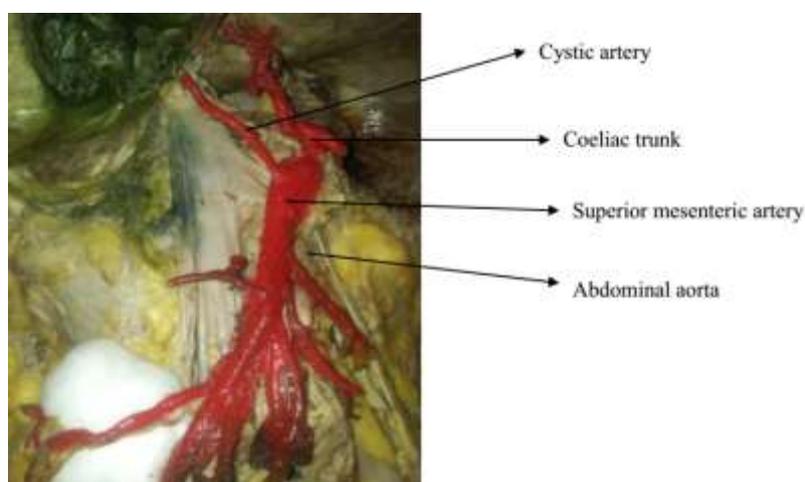
This paper presents a rare site of origin of the cystic artery, with detailed relationship with the surrounding structures, which was encountered in a 60 years old male cadaver during routine human cadaveric dissection in the Department of Anatomy, ESIC Medical College, Sanathnagar, Hyderabad, Telangana State, India. This report aims to highlight a case of anomalous origin of the cystic artery and its relation to the cystic duct, common hepatic duct and Calot's triangle.

## DISCUSSION

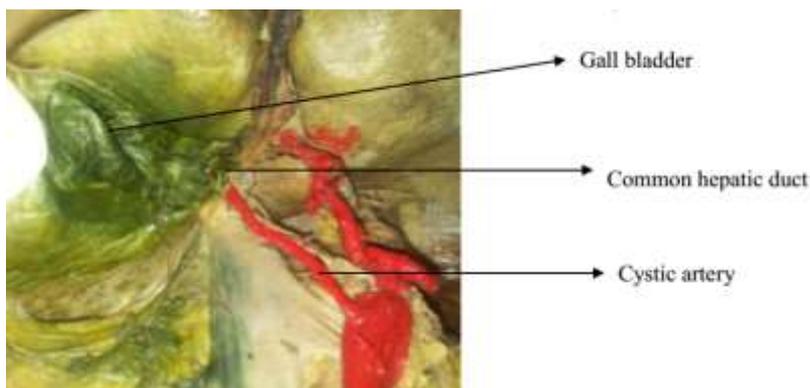
The cystic artery is known to exhibit variations in its origin and branching pattern. This is attributed to the developmental changes occurring in the primitive ventral splanchnic arteries. During development, the extra-hepatic biliary system arises from an intestinal diverticulum, which carries a rich supply of vessels

from the aorta, coeliac trunk and superior mesenteric artery. Later most of these vessels are absorbed, leaving in place the mature vascular system. As the pattern of absorption is highly variable, it is not unusual for the cystic artery and its branches to be derived from any other artery in the vicinity.

In the present case, the cystic artery originated from the superior mesenteric artery. The course of the cystic artery was traced, which was passing through the right free margin of lesser omentum along with the hepatic artery, common bile duct and portal vein. It was found to be ascending anterior to the portal vein and posterior to the hepatic artery. It has entered the Calot's triangle from behind the common hepatic duct and at the neck of the gall bladder divided into superficial and deep branches to supply the gall bladder. The similar finding was observed previously which was seen in a 43 year old male cadaver [3].



**Fig-2: Origin of cystic artery from the superior mesenteric artery**



**Fig-3: Course of the cystic artery behind the common hepatic duct**

Origin of cystic artery from the hepatic artery proper and common hepatic artery was also observed by several authors previously [4, 5]. A very unique origin of cystic artery from the third hepatic artery was also observed by a previous author [6]. Considering the fact that the diseases of the extra hepatic biliary apparatus often need surgical intervention, it is very important to

know anatomy of the same, which is frequently unusual.

## CONCLUSION

Knowledge of the different anatomical variations of the arterial supply of the gallbladder, liver and stomach is of great importance in hepato-biliary and gastric surgical procedures. During laparoscopic

cholecystectomy dissection of a limited field is magnified on the video monitor, which indicates that a detailed anatomical knowledge of the possible variations in the anatomy of the cystic artery and its branches is very important to the surgeon. The arterial variations should not be ignored and with an accurate knowledge on the anatomical variations, many operative and postoperative complications can be avoided. A good understanding of the arterial architecture definitely prevents surgical and angiographic mistakes that can occasionally become catastrophic. Further studies are needed to explore the CT variations which would enable the radiologists in protecting the important vessels prior to transcatheter therapies, and also in preventing inadvertent injuries.

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